Inventory and Monitoring
Florissant Fossil Beds National Monument

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Mosaics in Science Paleontology Intern/Museum Assistant, Summer 2014

Background

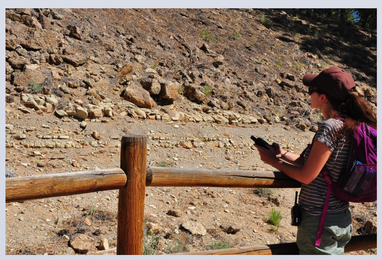
Panorama of the Florissant Valley. Photo: NPS

Florissant Fossil Beds National Monument is a unique, valuable natural asset to the National Park Service. Located in the Rocky Mountains of Colorado, this ancient lakebed has preserved Lagerstätten deposits of latest Eocene flora and fauna, as well as permineralized giant redwood stumps. This excellent fossil record can be attributed to Cenozoic volcanism of the Mt. Guffey stratovolcano which occurred in the region 34-35 million years ago. Lahar debris flows from the slopes of the volcano created a dam in a series of streams, filling the paleovalley to create ancient Lake Florissant, which would later preserve the fossils in paper thin shale layers. Late Eocene flora at Florissant represents a mix of warm temperate and subtropical taxa, a snapshot in time of an ancient ecosystem much different than Florissant today. Further, there is no modern analog for this plant community; modern relatives of Florissant flora are found in Asia and coasts of North America. Florissant's diverse fossil assemblage is of interest to many scientists and researchers interested in paleobotany, paleoclimate, paleoelevation and is an exceptional resource to understanding the past.

From left to right: *Palaeovespa florissantia*, wasp; *Fagopsis longifolia*, leaf of extinct beech family; and *Florissantia speirii*, flower of extinct genera. Photos: NPS

Inventory and Monitoring

The purpose of Inventory and Monitoring is to protect the paleontological resources at Florissant Fossil Beds National Monument. The Inventory and Monitoring project has been ongoing at Florissant Fossil Beds National Monument since its creation in 1992 by seasonal paleontologists. Researchers assisted in the initial inventory, identifying 55 sites that should be monitored. Since 1997 seasonal interns (and since 2001, GeoCorps interns) have worked on the project every summer and have expanded it to include a new digitized database in 2005-2006, re-examined sites and developed a protocol in 2007, made new baseline photos in 2008, and printed a manual in 2011.

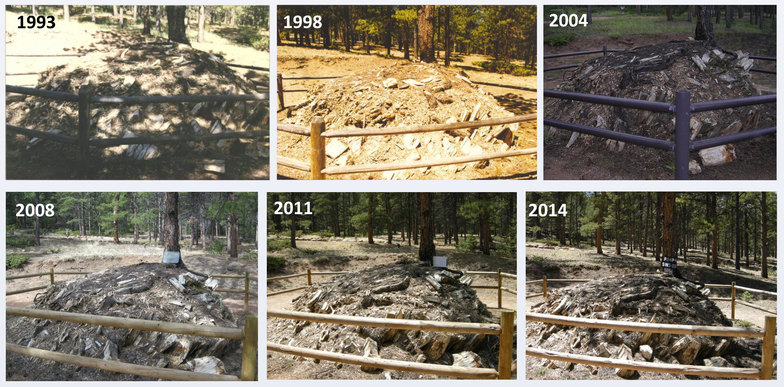


Goals of I&M

- Through inventory, the nature and status of natural resources in the Monument can be determined and sites can be put on record.
- Monitoring of site condition to assess changes through time, including illegal collecting (i.e. visitor activities), construction disturbances (i.e. NPS activities), natural physical processes (i.e. weathering, erosion, catastrophic events), natural biological processes (i.e. wildlife growth), and disturbances created by excavations and research
- The Program's data should be integrated into National Park Service planning, management, and decision making so that paleontological resources are better protected.

I&M Process

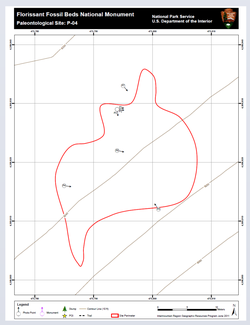
Documented sites are given a monitoring cycle of every 1-10 years based on their sensitivity. For 2014, 49 of the 72 sites in the Monument needed to be visited and evaluated.

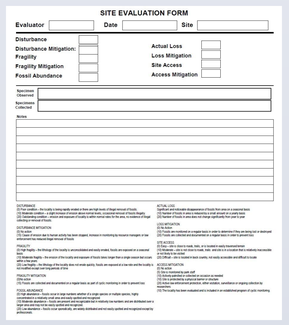


I&M photos for a petrified wood site on the Ponderosa Loop trail (location disclosed to the public). This petrified stump has a modern tree growing through it and is an interesting ecological time study to monitor. From left to right, top to bottom: 1993, 1998, 2004, 2008, 2011, 2014.

1. Using a GPS and site map, I hiked to the localities and found the sites.
2. Using baseline photos, previous cycle photos, and the Brunton compass, I took the photos at the designated photo points.
3. I assessed the sites' condition, completed site evaluations, scored sites, and took field notes.
4. After returning from the field, the photos and site evaluations are entered in the digitized database.
5. At the end of the I&M season, a final report is generated.

The results of this season's final report are 16 sites in good condition (score over 90), 33 fair in condition (scored 50-90), and zero sites in poor condition (score below 50). No major theft was documented this season.





Contributions to I&M

Besides completing this season's Inventory and Monitoring, I created a new guide to make the I&M project more consistent and easier to understand for future interns. Key aspects to this update include:

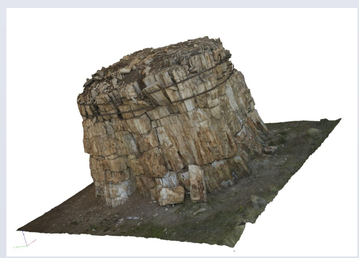
- Made the manual more appropriate for field work by using binders that allow interns to remove pages pertinent to the site being visited rather than carrying around one heavy volume, also printed on Rite in the Rain paper and using sheet protectors
- Refined site evaluation criteria to be specific to the unique characteristics of the paleontological resources present at FLFO
- Added records of new photo points and sites since the 2011 manual
- Added compass measurements to the azimuths on the 2008 baseline photo sheets; previously these data were not included or easily accessible and is crucial for precise photography of site photo points
- Added original 1992 photo sheets for each site to actually assess long-term changes while in the field
- Updated site information sheets and digital database with most current paleontology accession numbers and collection sites
- Combined and updated various documents of protocol written by past interns from the paleontology server in one location in the new guide in manual format
- Edited relevant changes to the manual protocol, including changes in equipment used and adding a section on Paleontological Resource Protection Act
- Updated naming scheme of photo monuments to be more consistent and logical

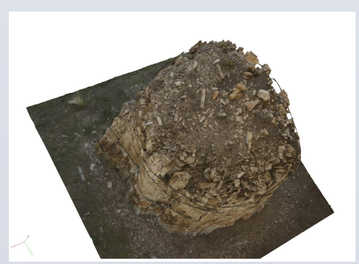
The Future of I&M

During my internship at Florissant, I was able to get a glimpse at the future of the Inventory and Monitoring Project. Photogrammetry is the next step to advancing I&M and making it even more effective in assessing paleontological resources by creating accurate and precise three dimensional images and models. A team from the Bureau of Land Management and a GeoCorps Guest Scientist from the Geologic Resource Division (pictured) came to Florissant to test the photogrammetry process on our petrified stumps, and I was able to assist them with the photos, learn the protocol for the process, and begin to imagine how we could apply it to I&M at Florissant.

Photogrammetry consists of taking hundreds of photos 10-15 degrees about an object using a wide angle lens, turning the camera at 90 and 270 degrees to create a stereoscopic overlap of 66%. The more redundancy and number of photos taken, the greater the success of the 3D model. The images are then uploaded into Agisoft Photoscan software which actually produces the 3D reproduction.

When dealing with a large object like the giant stumps, special equipment is needed to see the highest regions of the object, and the camera is mounted onto a monopod and connected with portable wireless internet to an iPad that can control the camera and show the viewing window. The monopod and iPad set up also allows the camera to stay steady and allows photos to be taken at various angles consistently that may otherwise be difficult. It is important to focus the camera once at a particular distance from the object, then maintain that distance for the entire set of photos. The use of multiple high quality, calibrated scale bars is also crucial.





Photogrammetry of the stumps was highly successful, and images of the preliminary 3D model produced by the BLM team are pictured at right. The PDF file allows the user to click and drag to maneuver the stump 360 degrees and zoom in to a more detailed view. Having 3D photogrammetric record of the stumps will make monitoring of change much more detailed and increase our understanding of the erosion or theft that goes on.

Acknowledgements

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